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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 15	)	
of the Commission's Rules to Permit	)	ET Docket No. 94-124
Use of Radio Frequencies Above 40 GHZ	)	RM-8308
for New Radio Applications	)	

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COMMENTS OF
GHZ EQUIPMENT CO., INC.

GHz Equipment Co., Inc. ("GEC") hereby submits these comments in response to the Notice of Proposed Rulemaking in the captioned proceeding, released November 8, 1994 ("*NPRM*"). In the *NPRM*, the FCC has proposed to open portions of the millimeter wave frequency bands above 40 GHz for licensed, commercial development -- whose collective uses the Commission has denominated "Licensed Millimeter Wave Service" or LMWS. *Id.* at ¶21. One segment of the vast amount spectrum contemplated for commercial use is 40.5 to 42.5 GHz. As discussed below, GEC urges the Commission to reserve 1 GHz of spectrum -- from 40.5 to 41.5 GHz -- for educational use and for application by accredited educational institutions or nonprofit organizations with an educational purpose. We will refer to this service as "Educational LMWS."

I. Introduction.

GEC, an equipment manufacturer and systems integrator, has been a leader in millimeter wave technology for the last several years. In addition to manufacturing, GEC's experience includes the planning of high frequency microwave systems for use in education. Most recently, GEC assisted a regional telephone company in the conceptualization and design of a plan to interconnect thousands of public schools, libraries and other institutions to a statewide network for access to the National Information Infrastructure ("NII"). GEC's research and experience in this area are a function of a corporate vision that includes a well-defined commitment to advance

the expansion of new technology in the service of education. In the *NPRM*, the Commission suggests various applications for spectrum above 40 GHz in the development of wireless radio systems with communications capacity that is currently achievable only by coaxial and optical fiber cable. Among these foreseeable applications, the FCC includes interconnection to the NII and "educational or medical applications such as remote wireless access to libraries or other informational databases." *NPRM* at ¶2.

It should be self-evident that a relatively modest reservation of spectrum for educational purposes -- from among the extensive segments of frequencies under consideration in this proceeding -- is vital to the national interest. In the coming years, more than in any other era of our Nation's history, education will be critical to our national agenda, particularly with respect to economic development and international competitiveness. Telecommunications technology must play an important role in delivering education and training to schools, businesses and homes. *See, e.g.*, "Linkup For Learning: A New Course For Education," Office of Technology Assessment (1989). The Congressional Office of Technology Assessment ("OTA") has noted that rapid advances in technology are creating distance learning systems that are far more powerful, flexible and, increasingly affordable than anything in the past, thus opening the prospect for enormous strides in education. *See* "The NTIA Infrastructure Report: Telecommunications In The Age Of Information," DOC/NTIA (1991). Telecommunications will be a powerful tool for delivering educational services to students of all ages and in all areas.

II. Potential Applications.

As the Commission noted in the *NPRM*, millimeter wave spectrum is suitable for many types of communications systems. Thus, "[t]he large amount of spectrum available at these frequencies can accommodate the wide channel bandwidth needed for rapid transmission of large volumes of data," including "transmission of high resolution video images, access to large data

bases, and ... access to the NII ...." *NPRM* at ¶9. GEC's research shows that services that can be accommodated in the 40.5 - 41.5 GHz spectrum include two-way interactive data and video networks linking schools, libraries, colleges, universities and other learning centers to the NII.

The two-way capability afforded by Educational LMWS technology will permit a level of academic flexibility and expansion previously unheard of in American education. If the technology can deliver educational materials, any suitable public room can be converted to a setting for conducting classes, seminars, or provide a variety of other services to citizens of the region. This will provide the capability to distribute basic skills improvement courses throughout the service area and give access to large segments of the population currently unable to enroll in these courses due to geographic isolation and other factors.

Rapidly escalating technological development has brought with it a vital need for retraining the American work force. This only exacerbates the existing difficulties involved in giving the working public courses in adequate quantities to satisfy this need while simultaneously insuring the quality of the educational product. Educational LMWS will provide a platform for the distribution of adult continuing education programs to receive sites throughout the country.

One of the most important benefits Educational LMWS offers is the prospect for increased levels of concurrent enrollment for high school students in ongoing college programs. For example, many public schools currently support college prep and honors programs. By establishing send and receive sites at high schools throughout a state, a state university system or other collective of institutions can give college bound students freshman level courses allowing them to earn semester credit hours while still in high school. This serves two important goals. First, it will accelerate the individual student's progress and enroll him or her in a university earlier than otherwise possible. Additionally, it will relieve a great deal of pressure being placed upon public institutions of higher education by effectively reducing the time that much of the freshman population will spend on

campus. Direct by-products of this will be the increased potential for significant redistribution of fiscal resources and higher graduation rates due to better preparation of public school students for moving into the demanding environment of a four-year university.

Finally, although long-haul technologies such as satellite, microwave and fiber are the major components of any "information superhighway," an economical, effective "last mile" delivery service is necessary to make sophisticated inter-active educational services universally available. Our research confirms that the 40 GHz spectrum is well suited for this purpose, meaning that even individual homes may receive the benefits of the type of educational service we envisage. While it is easy to imagine academic uses for the video portion of an Educational LMWS system, the system will handle data and voice as well as video in an interactive mode. Thus, its significance as a "last mile" technology -- a means to bridge the gaps that are commonly encountered in delivering institutional services to small facilities and individual users -- cannot be overstated, making the futurist's vision of a "university without walls and clocks" a modern-day reality. This technology offers the potential for fiber speed over a transmitted medium while making extremely efficient use of the available spectrum. In essence, Educational LMWS will provide higher education with the required tools for crossing the gaps so often encountered when dealing with other last mile conduits.

III. Educational LMWS Requires A Minimum Of 1 GHz Of Spectrum.

Distance learning systems are currently providing a window of opportunity to move public education into the 21st century and place it upon a sound foundation for the future. This base must be capable of meeting the demands of an information-based economy. Without adequate bandwidth capabilities and adequate spectrum to carry the information, any distance learning system will be crippled at its inception by an inability to meet the requirements of its institutional users. It is no longer acceptable to view data, voice, and video as separate elements that are only loosely connected. Rather, they must be viewed as the interleaved layers of a fully integrated

information stream. One of the major causes of first-year failures among new business ventures is undercapitalization. The virtual equivalent of undercapitalization in any distance learning system is an inadequate amount of channel capacity.

An approach that offers an answer to these obstacles is to use very high bandwidth fiber cables and satellite downlinks to connect and feed the major distribution points (MDP). The MDPs are represented in this design by the transmission head-ends located throughout the service area. With these MDPs distributed throughout major geographic areas, the basic infrastructure for a virtual Statewide educational information system will be established. Once an urban center or MDP is reached, the information stream needs to be moved to a wireless platform for local distribution. For a very large educational WAN, the best approach is a system that carefully integrates the best of both the wireless and wired technologies.

Meeting all of the requirements, challenges, and loads levied upon any distance learning system is a significant challenge. The factors that complicate this formula include the sheer quantity of information that needs to be transported, the meeting of stringent qualitative standards imposed by governmental bodies providing educational oversight, and the coordination of programming that often crosses dozens of disciplinary lines.

As an alternative platform for hosting a WAN, Educational LMWS offers the option of varying spectral efficiency within acceptable signal to noise limitations on digital channels and efficiently using the spectrum for point to multipoint delivery on analog channels all within the spectrum allocated to the same system. A subdivided system can be allocated so that specific channels will transmit analog video point to multipoint over 20 MHz bandpass segments and 10 MHz segments running high quality compressed digital video at T-1 rates. Channels can be operating as T-1 circuits and, if multiplexed, can carry acceptable quality instructional video,

data, and voice information simultaneously. This design will allow the system participants to interact effectively.

Although it is possible to vary spectral efficiency and, as is often done, increase bandwidth in any given 10 MHz bandpass up to 45mbps, the costs involved in achieving that level of efficiency are prohibitive. These costs would be greatly compounded when attempting to maintain this level of spectral efficiency in the 40 GHz portion of the spectrum. A 10 MHz bandpass operating at the T-1 rate of 1.54mbps is a technically and fiscally achievable goal. The 24 DS-0s contained within each T-1 can be multiplexed, at the end-user educational site, and segmented for use as high-quality interactive video, individual voice circuits with local dial-up capabilities to any other networked site, and linked through a router to provide very high-speed data capabilities and direct connections to the Internet.

Using T-1 service as the standard for point to point links contained within each service area will also open the option of using inverse MUXs at key points in the network to allow schools access to dial-up 56kbps switched service. This will extend the reach of the compressed digital video elements of the network to National and International points of contact. Using the dial-up protocol will provide the added advantage of letting the institutions pay for service that goes beyond the geographic boundaries of the network domain by the minute and the hour rather than by the year as is the case with dedicated T-1 lease service. Many high schools, for example, cannot afford to operate their own digital PBX, but if provided with a wireless T-1 link, they can reach a shared inverse MUX that will allow them to use dial-up service at rates higher than the 4-line ISDN system will permit.

Analog channels programmed into the 20 MHz bandpass segments will serve as an excellent vehicle for the delivery of this material. To a limited extent, ordinary voice circuits established on 800 service and ISDN lines will fill the need for cost-effective response

mechanisms should they be needed. Positive examples of this type of scheme are presently in operation. A consortium of Mexican universities in Monterrey, Mexico uplinks college level courses from a head-end system at Monterrey Tech to the Morelos satellite. The program is then received at 26 sites located across Mexico while the students, at these remote receive stations, ask their questions and give their responses using terminals and workstations connected to the Internet.

These factors come together to illustrate one fundamental point: The minimum frequency allocation any viable and effective educational system operating in the 40 GHz range will need is 1000 MHz. This will allow operators enough flexibility to provide a wide range of analog point to multipoint services while simultaneously delivering point to point two-way digital links that they connect through routers and hubs to provide broadband wide area network services over a wireless medium. These complementary platforms will allow for the ongoing development of a carefully integrated wireless information network into a larger living system that serves all of the needs of the educational community.

A license for less than an adequate amount of spectrum simply will not allow for adequate channelization of the delivery platforms. It can be expected that most distance learning systems that are built and designed simultaneously to serve elementary schools, middle schools, high schools, and colleges will need at least 25 analog channels for the one-way delivery of educational programming. This allocation by itself, using a bandpass size of 20 MHz, consumes a total of 500 MHz. Another 500 MHz broken into 10 MHz divisions will create a 50 channel capability for T-1 service on a point to point basis. Even this may not be enough when one considers that every high school in the service area will require at least one T-1 channel and "Magnet High Schools," that specialize in the medical arts and other scientific disciplines, may quickly find use for multiple links when additional capacity is needed for high-bandwidth data transmissions.

Inadequate channel capacity will create an unhealthy environment where local quality standards and local productions, designed to meet local needs, will always be subject to the exigencies of Statewide programming. There should be room on every educational system to accommodate the requirements and demands of all of the stakeholders that have an identified interest in the content of the program materials carried by that system.

IV. Other Issues.

(A) Auctions Would Not Apply To Educational LMWS. The Commission proposes the use of auctions to award LMWS licenses. *NPRM* at ¶25. Auctions, however, presumably will not apply to Educational LMWS, just as this mechanism does not apply to applicants in other spectrum, such ITFS, reserved for educational purposes under current rules. Instead, we recommend that, in the event of competing applications, an efficient selection system be established, perhaps analogous to the point system set forth in Section 74.913 of the Commission's Rules.

Considering the sheer magnitude of the spectrum under consideration in this proceeding, on one hand, and the vital need for channel capacity for educational purposes, on the other, it would seem improbable -- even irresponsible -- that the Commission should decline to reserve a portion of this spectrum for strictly educational use. Nevertheless, in that unlikely event, the Commission should require commercial LMWS licensees to provide free or reduced-rate access to qualified educational entities seeking to distribute their programming to the public. Congress, the FCC and many local franchising authorities have already mandated such access with respect to other technologies including cable TV, wireless cable and DBS, and there are extant regulatory models for the FCC to rely upon in developing appropriate access requirements. *See, e.g.*, Section 74.992 of the Rules; *and* Section 25 of the Cable Television Consumer Protection And Competition Act of 1992.

(B) Division Of Spectrum. At ¶23 of the *NPRM*, the Commission recommends a division of frequencies modeled on that proposed in the pending LMDS proceeding. Accordingly, with respect to the 40.5 to 42.5 Ghz band, the Commission contemplates a division into two 1,000 MHZ blocks. We concur with this proposal, which would accommodate the award of one Educational LMWS license per service area with the quantity of spectrum for educational purposes that our research indicates is necessary. The frequencies in the licensed blocks should be contiguous.

(C) Service Areas. The FCC recommends Rand McNally Major Trading Areas (MTAs) as LMWS service areas. *NPRM* at ¶24. We are concerned that regions of this size, of which there are only 47 in the entire country, will put unduly burdensome build-out requirements upon educational licensees. Moreover, depending upon the particular region, user needs and programming requirements can vary significantly between areas closely situated. A major medical complex in an urban area will have requirements quite different from those associated with service to a more rural population, although the two may be separated by distances that fall easily within the bounds of an MTA. For these reasons, we urge the Commission to adopt Metropolitan Statistical Areas as the service areas for LMWS.

V. Conclusion.

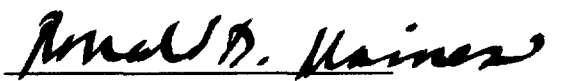
Educational LMWS will be a framework for the delivery of broadband services to public schools, libraries and community colleges throughout the Nation as an "on-ramp" to the Information Superhighway. Without the ability to connect to this infrastructure, these institutions, regardless of their internal capabilities, will not be able to avail themselves of the multitude of federal and international resources that require high-bandwidth access. Many state institutions already have, or are in the process of designing and installing, high bandwidth broadband digital networks. These networks will allow such institutions to transfer enormous amounts of data, in a multimedia

environment, within their own virtual boundaries. The communications network envisaged herein will be fully commensurate with these evolving intrastate and interstate capabilities. Absent such a network, states will find themselves with a host of micro-sized information backroads and no practical method to connect them to the NII.

For these reasons, we urge the Commission to set aside the 40.5 to 41.5 GHz spectrum for educational use.

Respectfully submitted,

GHz EQUIPMENT CO., INC.

By 
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